Comments on `The temperature dependence of homogeneous field breakdown in synthetic air' by W.S. Zaengl et al

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[8] H. M. Banford, I. D. Chalmers, P. Chalmers and D. J. Tedford, "Sparkover Phenomena in Air and Arcton 12 at High Values of pd", International Conference on Gas Discharges, London 1970. IEE Conference Publication No.70, pp. 273–278, 1970.

[9] Th. Aschwanden, "Swarm Parameters in SF_6 and SF_6/N_2–Mixtures Determined from a Time Resolved Discharge Study", in L. G. Christophorou and M. O. Pace (eds), *Gaseous Dielectrics IV*, Pergamon Press New York, pp. 24–33, 1984.

[10] J. G. Carter, S. R. Hunter and L. G. Christophorou, "Temperature Dependent Electron Transport and Rate Coefficient Studies for e-Beam-Sustained Diffuse Gas Discharge Switching", in L. G. Christophorou and D. W. Bouldin (eds.), *Gaseous Dielectrics V* , Pergamon Press New York, pp. 47–54, 1987.

[11] T. F. O'Malley, "Calculation of Dissociative Attachment in Hot O_2", Phys. Rev., Vol. 155, pp. 59–63, 1967.

[12] M. Yousfi, *Contribution à l'étude de la théorie cinétique des électrons dans un gaz faiblement ionisé*, Thèse du grade de docteur d'etat, no. 1244, Université Paul Sabatier de Toulouse, 1986.

[13] M. Cacciatore, M. Capitelli and C. Gorse, "Non-Equilibrium Dissociation and Ionization of Nitrogen in Electrical Discharges: the Role of Electronic Collisions from Vibrationally Excited Molecules", Chemical Physics, Vol. 66, pp. 141–151, 1982.

[14] C. E. Treanor, J. W. Rich and R. G. Rehm, "Vibrational Relaxation of Anharmonic Oscillators with Exchange-Dominated Collisions", J. Chem. Phys., Vol. 48, pp. 1798–1807, 1968.

[15] G. Herzberg, *Molecular Spectra and Molecular Structure*, Van Nostrand Princeton NJ, 4 volumes, 1950–1979.

[16] E. Kuffel and W. S. Zaengl, *High Voltage Engineering, Fundamental*, Pergamon Press Oxford, 1984.

[17] P. Segur, M. Yousfi and M. C. Bordage, "Comparison between Different Methods of Solution of the Boltzmann Equation Adapted to the Calculation of Swarm Parameters in a Weakly Ionized Medium", J, Phys. D: Appl, Phys., Vol. 17, pp. 2199–2214, 1984.

[18] A. V. Phelps, "Laboratory Studies of Electron Attachment and Detachment Processes of Aeronomic Interest", Canadian J. Chem., Vol. 47, pp. 1783–1793, 1969.

[19] H. Tagashira, "Development of Electron Avalanches at High Electric Fields", Proceedings XV International Conference on Phenomena in Ionized Gases (Invited Papers), pp. 377–394, Minsk 1981.

[20] M. Ducos, *Calcul des grandeurs macroscopiques dans l'oxygène et láir sec*, Thèse 3 ème Cycle, Université Paul Sabatier de Toulouse, 1982.

[21] S. A. Lawton and A. V. Phelps, "Excitation of the $b^1\sum^+ g$ State of O_2 Low Energy Electrons", J. Chem. Phys., Vol. 69, pp. 1055–1068, 1978.

[22] T. H. Teich, "Electron Drift and Attachment in Nitrous Oxide", Paper submitted to XX International Conference on Phenomena in Ionized Gases, Pisa 1991.

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EDITORIAL FOOTNOTE

In the above paper by Zaengl, Yimvuthikul and Friedrich, the unit Townsend (Td) is employed when referring to gaseous collision parameters. For this unit we have

$$1\ \text{Td} = 10^{-17}\ \text{V cm}^2 = 10^{-18}\ \text{kV mm}^2$$

The Townsend was introduced by gas-discharge physicists [1, 2] who prefer to employ the gas number density N when referring to the energy related parameter E/N rather than E/p, where p is the gas pressure at temperature T, and E the electric field strength.

With reference to electrical insulation, it may be argued that, on grounds of its magnitude, the Townsend is an impractical unit. In addition, p and T remain the measured variables from which the corresponding N is deduced via the ideal gas law. If however, the gas in question is non-ideal, *e.g.* SF_6, the evaluation of N also requires a knowledge of the gas compressibility factor $Z(p,T)$, $Z \leqslant 1$. Values of Z can be derived if the relevant virial coefficients are known.

REFERENCES

[1] L. G. H. Huxley, R. W. Crompton and M. T. Elford, "Use of the Parameter E/N", Brit. J. Appl. Phys., Vol. 17, pp. 1237–1238, 1966.

[2] The Editor, "Use of the Parameter E/N", Brit. J. Appl. Phys., Vol. 18, p. 691, 1967.

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